Original Research Article

Prevalence and cardiovascular risk factors associated with obesity/overweight in adult patients living with HIV/AIDS: Case of the Makokou Outpatient Treatment Center, Ogooué-Ivindo, North-eastern Gabon

Abstract

Background: Designed to fight HIV/AIDS, antiretroviral drugs (ARVs) may be responsible for certain cardiometabolic abnormalities in people living with HIV (PLWHIV). To this end, the present study evaluates the prevalence and impact of obesity/overweight on the development of cardiovascular risk factors in patients at the outpatient treatment center (CTA) of Makokou, in the Ogooué-Ivindo region, North-eastern Gabon.

Materials and Methods: This is a cross-sectional and descriptive study, based on a retrospective analysis of the records of patients followed at the HIV/AIDS outpatient treatment center of Makokou from December 2015 to December 2020. A structured questionnaire was used to collect data such as age, gender, socio-economic level, daily habits such as alcohol consumption, tobacco consumption, and physical exercise. Other epidemiological parameters such as body mass index (BMI), and CD4 count were measured.

Results: A total of 165 people living with HIV (PLHIV), the majority of whom were between 41 and 60 years of age (60.60%). treated with antiretrovirals from December 2016 to December 2021 were collected for this study.. With a sex ratio (F/M) of 3.58, women (78.2%) were in the majority compared to men. The mean age was 51 ± 13

years. While 95.8% of the patients were from the different departments of the province of Ogooué-Ivindo, the remaining patients (4.8%) were from other provinces such as Estuaire, Haut-Ogooué or Ogooué-Lolo. Civil servants represented 21%. The self-employed represented 29%, and the unemployed represented 50%. Only 34% of the participants in the study, the majority of whom were women, engaged in regular physical activity. 5.4% of the patients, mostly men, were active smokers. 34%, especially women, consumed alcohol. 20% of the PLWHIV had a medical history of type 2 diabetes mellitus or hypertension (HTA), and the majority were female. 5.4% of the declared hypertensives were on treatment. 7.8% of the hypertensive patients were discovered in consultation. The remainder were normotensive (86.8%). A significant difference in hypertension was observed in patients aged between 41 and 60 years (p= 0.0029*). The data revealed a positive correlation index (r=0.19) between BMI and hypertension. All the therapeutic combinations with which the patients were treated contained NRTIs, of which the most used were tenofovir disoproxil (TDF) 66.67% and lamivudine (3TC) 33.33% and finally the most used NRTI was Efavirenz (EFV) 76.36%. After 5 years of treatment, 89 PLWHIV (53.93%), had CD4 count ≥ 500 cells/mm^3. 53 PLWHIV (32%) had CD4 count ranging from 200 - 499 mm^3 and thus moderate immune deficiency and with CD4 count < 200 cell /mm^3, 23 PLWHIV (14%) had severe immune deficiency. HIV-infected patients under 40 years of age had a mean CD4 count of 412 cell/mm^3, which was lower than that of patients 40 years of age and older, which was 556 cell/mm^3. It was noted that after 5 years, treatment with ARVs was significantly associated with an increase in BMI among PLHIV, (P=0.0210). It was indicated that the increase or decrease of CD4 count in PLWHIV, depended on BMI, after 5 years of ARV treatment.

Conclusion This study confirms the existence of an increase in overweight and obesity in people living with HIV/AIDS under antiretroviral treatment. It also shows that obesity had an impact on the development of certain cardiovascular risk factors in these people, which require careful vigilance of the health personnel on their weight gain, due to lipidic parameters such as cholesterol, HDL, Triglycerides.

Keywords: Prevalence; cardiovascular; obesity/overweight; HIV/AIDS; Makokou; Gabon

I. INTRODUCTION

Discovered in the 1980s, HIV is still a pandemic that can affect any person, regardless of gender, age, ethnicity or even culture. Now considered a chronic inflammatory disease due to its morbidity and mortality, HIV is a real public health problem in the world [1]. Since the development of antiretroviral therapies, there has been a real decrease in the incidence of opportunistic diseases and an increase in life expectancy among people living with HIV (PLHIV) [2, 3]. However, despite the improvement in their living conditions, antiretroviral drugs are said to be the cause of new causes of death [4, 5]. Studies have shown a direct involvement of antiretrovirals in abnormalities that may favor the development of certain so-called "cardio-metabolic" diseases [6, 7]. Thus, certain molecules have shown the capacity to promote an imbalance in energy metabolism, leading to weight gain for some. This is the case of protease inhibitors (PI) and non-nucleoside reverse transcriptase inhibitors (NNRTI) [8].

In addition to the consumption of tobacco and alcohol, a sedentary lifestyle and immune deficiency, implicated in the development of certain cardiovascular and metabolic diseases, the development of certain risk factors such as weight gain or obesity in patients under antiretroviral treatment is defined by the increase in body mass index (BMI) [9]. Despite the incrimination of the treatment, HIV is directly involved in a metabolic disorder that leads to dyslipidemia with a high elevation of triglycerides at an advanced stage of the disease [10]. All this disorder orchestrated by the virus itself and the antiretroviral treatment make PLWHIV, potential targets at risk for cardio-metabolic diseases. To this effect, the scarcity of studies conducted in this context in Gabon, are the crucible of the lack of data in this regard. Therefore, this study aims to evaluate the prevalence and cardiovascular risk factors associated with obesity/overweight among PLHIV followed at the Makokou Outpatient Treatment Center (CTA-MKK) in North-eastern Gabon.

II. PATIENTS AND METHOD

II.1 Type and setting of the study

This is a cross-sectional and descriptive study, based on a retrospective analysis of the records of patients followed at the Makokou HIV/AIDS outpatient treatment center from December 2016 to December 2021. The study population consisted of adult individuals living with HIV and treated with antiretroviral drugs for 5 years.

II.2 Inclusion and exclusion criteria

All other patients were included in this study, except those lost to follow-up, those with missing biological or socioeconomic and demographic data necessary for the study. Data on viral load were not available for all patients for technical reasons, so this parameter was removed from this study.

II.3 Data collection from the medical records of the HIV patients in the study

This consisted in collecting epidemiological parameters such as age, sex, socio-economic level, biological parameters and daily habits such as alcohol consumption, smoking, physical exercise, recorded during the last appointment of the PLWHIV, for his or her therapeutic follow-up assessment (TMA). The Body Mass Index (BMI) was considered normal for a value ranging from 18.5 to 24.9 kg/m². The individual was lean for BMI < 18.5 kg/m²; overweight if BMI varied between 25 and 29.9 kg/m² and obese if BMI ≥ 30 kg/m². Severe immune deficiency was defined as CD4 < 200cell /mm^3, moderate deficiency as CD4 ranging from 200 - 499 cell / mm^3 and good immunity if CD4 ≥ 500cell /mm^3.

II.4. Data processing

The collected data were processed in an Excel 2016 database and the statistical analysis was performed using the R software.The tests used were Spearman's rank correlation, exact binomial test, Studen's test, One-factor Anova. The threshold of significance was 5%.

III. RESULTS

III.1 Socio-demographic characteristics of the PLWHIV in the study

A total of 165 patients were recruited for this study, with a sex ratio F/M = 3.58, there was a predominance of females, 129 (78.2%) to 36 (21.8%) males. The average age was 51 ± 13 years, with patients in the 41-60 age group being in the majority (60.60%), followed by the 60+ age group being the most represented (23.04%). With a minimum age of 19 years and a maximum age of 82 years, the patients came from the different departments of the province of Ogooué-Ivindo, our study site, and from some neighbouring provinces. 53.9% of the patients came from Makokou (Ivindo), the provincial capital, 32.3% from Mékambo (Zadié), 7.8% from Boué (Lopé), 1.2% from Ovan (Mvoung), and the remainder, including 4.8%, came from other provinces such as Estuaire, Haut-Ogooué or Ogooué-Lolo. Divided into three groups, the population of this study was composed of civil servants who represented 21%, the private sector, made up of self-employed people such as shopkeepers and farmers, represented 29%, and the unemployed, made up of unemployed people, pupils or students, represented 50%. Only 34% of the study participants, the majority of whom were women, engaged in regular physical activity defined as working in the fields and on forestry sites. While 5.4% of the patients, mainly men, were active smokers, 34% of the patients consumed alcohol, mainly women. Table 1

Table 1: Socio-demographic characteristics of the PLWHIV in the study

Parameters	Number	Percentage (%)
Gender		
Male	36	21.8
Female	129	78.2
Age		
≤ 20 ans	10	6.06
21 - 40 ans	17	10.30
41 - 60 ans	100	60.60
≥ 60 ans	38	23.04
Departments		
Ivindo	89	53.9
Zadié	53	32.3
Lopé	13	7.8
Mvoung	2	1.2
Others	8	4.8
socioeconomic level		
Civil servants	35	21
Self-employed	48	29
Unemployed	82	50
Physical activities		
Yes	56	34
No	109	66
Smokers		

Yes	9	5.4
No	156	94.6
Alcohol		
Yes	56	34
No	109	66

III. 2. Medical history of the PLWHIV in the study

Taking into account the medical history, 20% of the PLHIV in this study admitted to having had a medical history of type 2 diabetes mellitus or high blood pressure (HBP), the majority of whom were female. 5.4% of the PLHIV were declared hypertensive and on treatment. 7.8% of the patients with HBP were discovered during follow-up visits. The remainder were normal HBP (86.8%) Table 2.

Table 2: Medical history of the PLHIV in the study

Medical history	Numbers	Percentages (%)
Yes	33	20
No	132	80
Hight Blood pressure		
Known and treated HBP	9	5.4
HBP unknown	13	7.8
Normal HBP	143	86.8

III.3 Correlation between age and hypertension among PLWHIV study

Regardless of gender, there was a significant difference in the presence of hypertension, which was higher among PLWHIV in the age group of 41 to 60 years and above, (p=0.0029). The data revealed a correlation (r=0.19) between age and hypertension among PLWHIV of study. Table 3

Table 3: Correlation between age and blood pressure in study patients.

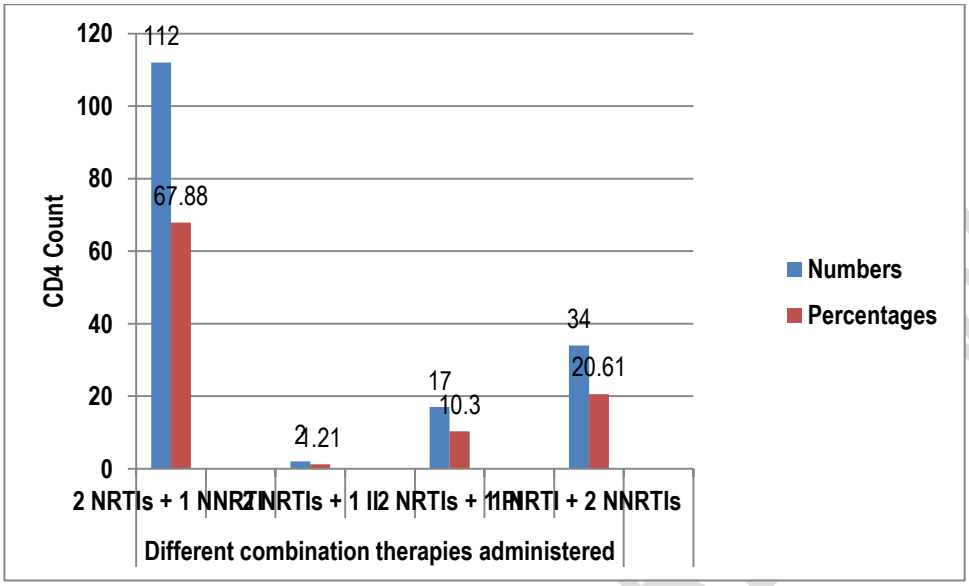
Age groups	**Blood pressure** (HTA)	**Percentage (%)**	**p-value**
≤ 20 ans	10	6.06	
21 - 40 ans	17	10.30	
41 - 60 ans	102	61.81	p= 0.0029*
≥ 60 ans	36	21.83	

III.4. Therapeutic combinations used by study PLWHIV

During the five years covering the time interval for this study, the different therapeutic combinations used to treat HIV patients consisted of Nucleoside Reverse Transcriptase Inhibitors (NRTI), Non-Nucleoside Reverse Transcriptase Inhibitors (NNRTI), Protease Inhibitors (PI) and Integrase Inhibitors (II). These different first-line combination therapies were composed of : 2 NRTI + 1 NNRTI n=112 (67.88%), 2 NRTI + 1 II n=2 (1.21%), 2

NRTI + 1 PI n=17(10.30%) and 1 NRTI + 2 NNRTI n=34 (20.61%). It can be seen that all the combinations contained NRTIs, the most used of which were tenofovir disoproxil (TDF) with 66.67% and lamivudine (3TC) with 33.33% and finally the most used NNRTI was Efavirenz (EFV) with 76.36%. Figure 1

Figure 1: Different therapeutic combinations administered to PLHIV during the study



III.5. Distribution of the CD4 count after 5 years of treatment of the PLHIV in the study

Considering severe immune deficiency for a CD4 count < 200 cell/mm^3, moderate deficiency for a CD4 count ranging from 200 to 499 cell/mm^3 and good immunity if CD4 ≥ 500 cell/mm^3, after 5 years of treatment, 89 PLHIV in the study or 53.93%, had a CD4 count ≥ 500 cell/mm^3. 53 PLHIV or 32% had a CD4 count between 200 and 499 cells/mm^3 and thus a moderate immune deficiency and with a CD4 count < 200 cells/mm^3, 23 PLHIV or 14% had a severe immune deficiency. The HIV-infected patients in the study who were under 40 years of age had a mean CD4 count of 412 cells/mm^3, which was lower than that of patients in the age group 41-60 years and above, which was 556 cells/mm^3 Table 4.

Table 4: Distribution of CD4 count after 5 years of antiretroviral treatment for HIV patients in the study

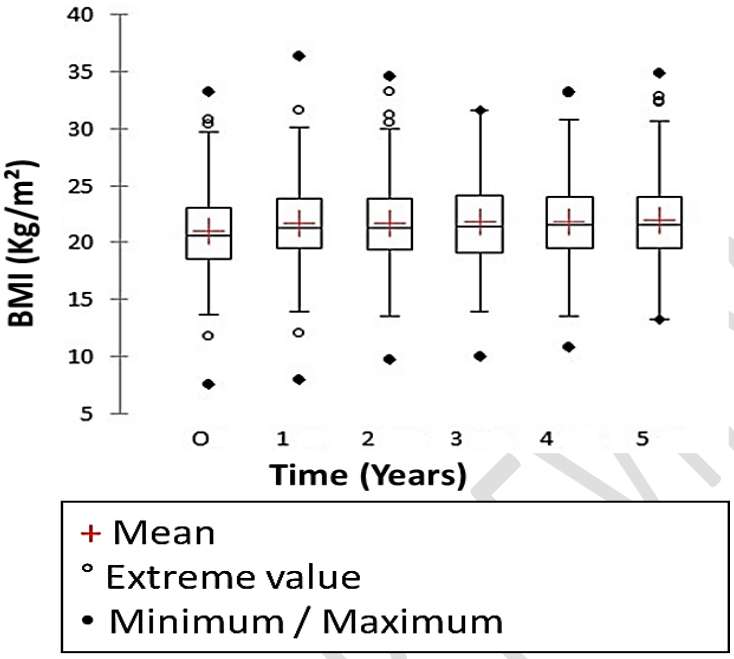
Age groups (years)	**CD4 rate after 5 years of treatment of study PLWHIV**		
	< 200	200 -499	≥ 500
≤ 20 ans	1	7	2
21 - 40 ans	1	5	11
41 - 60 ans	20	31	51
≥ 60	1	10	25
Total number of PLWHIV	23	53	89

III.6. Evolution of the BMI of the patients, according to the weight taken at each check-up in the study PLWHIV.

Figure 2, represented by box plots, shows that thanks to a symmetry of BMI distribution around the median during the 5 years of follow-up of the PlwHIV, the median and the mean remained very close. While the maximum

values of BMI tended to stabilize around 35 kg/m², the minimum values followed an increasing curve, thus indicating an increase in BMI of the PLWHIV observed, from the first (p=0.0001), until the fifth year of treatment.

Figure 2. Boxplots represent the distribution of BMI from case opening (OD) to year five of treatment



III.7. Prevalence of BMI between the opening of the file (OD) and after 5 years of antiretroviral treatment (ART).

The observation of the distribution of the PLWHIV in the study according to BMI levels showed that for a BMI lower than 18.5 kg/m², there were 30 PLWHIV at the opening of the file against only 25 after 5 years of treatment. For a BMI between 18.5 and 24.9 kg/m², there were 104 PLWHIV at the beginning of the file compared to 93 PLHIV after 5 years of treatment. For a BMI value between 25 and 29.9 kg/m², there were 31 PLWHA at the opening of the file against 40 PLWHA after 5 years of treatment. Finally, for a BMI greater than or equal to 30 kg/m² considered as obese, there were none at the opening of the file (OD), but 5 years later, there were 7 PLWHA. It was noted that 71 or 43.03% of the PLWHIV in the study treated with antiretrovirals were overweight and 7 or 4.42% were obese. The analysis of the level of significance of the differences observed in the percentage of PLWHIV at the opening of the file (OD) and after 5 years of antiretroviral treatment (ART) according to BMI values was carried out using a Fisher's exact test , with a 95% confidence interval. The test was considered significant when p-value ≤ 0.05. We can see that after 5 years, treatment with ARV is significantly associated with an increase in BMI among PLWHIV with a BMI greater than or equal to 30 kg/m² (p-value =0.0210) Table 5.

Table 5. Prevalence of BMI at baseline (OD) and 5 years after ART.

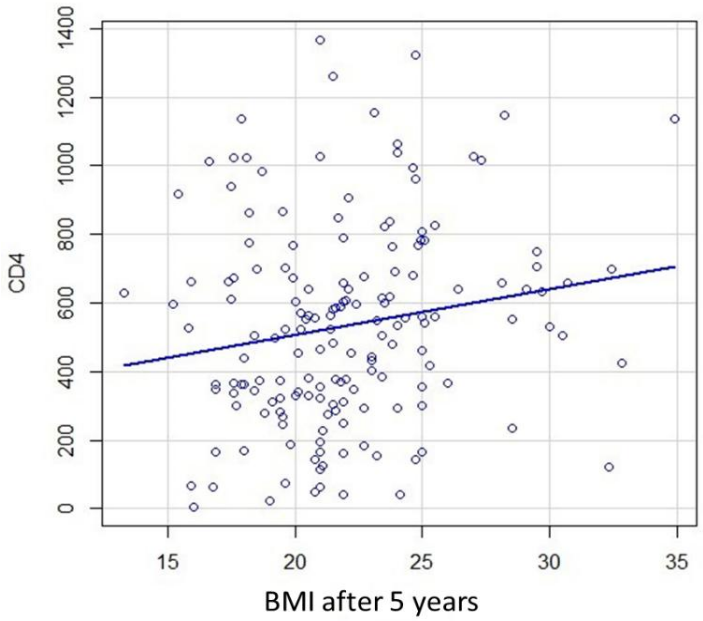
BMI (KG/M²)	OD	5 YEARS AFTER	p-value
< 18,5	30	25	
18,5 - 24,9	104	93	
25 - 29,9	31	40	0.0210 *
≥ 30	0	7	

TOTAL	165	165
*** SIGNIFICATIVE TEST.**		

III.8. Correlation between CD4 count and BMI after 5 years of antiretroviral treatment

Despite a low correlation coefficient, r = 0.1, figure 3 shows a significant correlation (p=0.02) between BMI and CD4 count of HIV-positive patients in this study. There is a clustering of scatter plots around the correlation line, indicating that the increase or decrease in CD4 count in HIV-infected individuals is dependent on BMI after 5 years of antiretroviral treatment..

Figure 3: Correlation between CD4 count and BMI after 5 years of antiretroviral treatment



IV. DISCUSSION

The objective of this study was to assess the prevalence and cardiovascular risk factors associated with obesity/overweight in adult patients living with HIV/AIDS: the case of the outpatient treatment centre of Makokou, in central-eastern Gabon. The population in this study was predominantly female, with a sex ratio (F/H) of 3.58. This corroborates studies conducted in Burkina Faso which reported a sex ratio (F/H) of 3.6, compared to 0.8 found by other studies [11]. These data may be related to the large female population in our study area, but also to the current feminisation of HIV/AIDS infection [12], due to the anatomy of the female genital tract, which is a more favourable environment for HIV infection than that of men. Furthermore, women are more likely to be tested for HIV than men because they are more willing to be tested, and more importantly, the implementation of mandatory sentinel surveillance of HIV in pregnant women, initiated as part of the Prevention of Mother-to-Child Transmission of HIV (PMTCT) worldwide, contributes significantly to the testing of a large number of women [13]. This category of young adults, the majority of whom are in the 41 to 60 age group (60.60%), explains the youthfulness of

the study population, which is very sexually active and often more affected by HIV/AIDS, but more aware of and more active in the therapeutic follow-up of the infection [12]. In line with work done elsewhere, half of the study population was unemployed, mostly sedentary and physically inactive (66%) [14]. 14] Although lower, this result is consistent with other studies that have shown that more than 90% of PLWHIV were sedentary [15]. In this study, only 33 PHAs, or 20%, admitted to having a medical history of type 2 diabetes mellitus or hypertension, the majority of whom were women. Contrary to some studies that have reported prevalences two to three times higher among people living with HIV [16], this study shows that 13.2% of PLWHIV were hypertensive. This result is close to that of Djalloh et al who found 14.9% [17] and Mukeba-Tshialala et al who reported a prevalence of 11.5% [14].This could be explained by the presence of other co-infections, such as hepatitis C virus, especially in women, as reported in a Spanish study [18]. Although the prevalence of hypertension was high in this study, in contrast to a Spanish study that found that age was not a factor associated with hypertension in PLHIV [18], a positive association between high blood pressure (HBP) and age was observed. Thus, the age group 41-60 years was most at risk [15]. The different first-line combination therapies used to treat PLWH in this study consisted of : 2 NRTIs + 1 NNRTI (67.88%), 2 NRTIs + 1 PI (1.21%), 2 NRTIs + 1 PI (10.30%) and 1 NRTI + 2 NNRTIs (20.61%). These results are not far from those obtained elsewhere [11,13]. For the different combinations, all the combinations contained NRTIs, of which the most used were tenofovir disoproxil (TDF) with 66.67% and lamivudine (3TC) with 33.33% and finally the most used NNRTI was Efavirenz (EFV) with 76.36%.This corroborates the fact that the choice of therapeutic combination is very important from the beginning of the treatment. This choice is often made on a case-by-case basis, taking into account the particularities of each patient. After 5 years of antiretroviral treatment, 89 PLWHIV in the study, i.e. 53.93%, had a CD4 count ≤ 500 cells/mm^3. This result is close to the study conducted by Pugliese et al who found a prevalence of 52% [19]. In this study, individuals in the 41-60 age group had a higher mean CD4 count than those in other age groups. This result is contrary to a study that showed an inverse correlation between age and CD4 count [, suggesting that younger age favours rapid restoration of immunity due to preserved thymic function [20]. Consistent with other studies, the present study showed a significant increase in BMI during the first year of treatment [21], which continued to evolve this time, but not significantly, until the fifth year. At the end of 5 years of antiretroviral treatment, the prevalence of overweight/obesity in patients in this study was 18%. This result is identical to that obtained in a study conducted in the DRC among PLWHA [14], and may corroborate with the initial choice of the different therapeutic combinations. The analysis of the significance level of the observed differences in the percentage of PLHIV at baseline (OD) and after 5 years of antiretroviral therapy (ART), according to BMI values, performed using an exact binomial test, with a 95% confidence interval, and considered significant when the p-value ≤ 0.05, showed that after 5 years, ART treatment was significantly associated with an increase in BMI in PLHIV with a BMI greater than or equal to 30 kg/m² (P=0.0210). These results are in agreement with those obtained in other studies, in which it was indicated that ARV combinations were more lipidogenic, and this is the case for the INT+IP combination [22]. In contrast to the data obtained by Crum-Cianflone [23], which indicated that increased BMI could lead to a decrease in CD4 replication rate, this study observed a positive correlation between BMI and CD4 count, as reported by Womack and colleagues who showed an association between morbid obesity and high CD4 count [24].

V. CONCLUSION

The prevalence of obesity/overweight in patients living with HIV evolved to nearly 3% in 5 years of antiretroviral treatment. This was independent of age; however, it had an impact on the increase in blood pressure and the evolution of CD4 count. In addition to age beyond 40 years, weight gain was one of the most important cardiovascular risk factors in PLWHIV. This weight gain was very important from the first year of treatment and appeared to change slightly during follow-up. These results invite treating physicians and health care personnel, responsible for the follow-up of PLWHIV, to monitor the weight gain of PLWHIV to prevent the development of cardio-metabolic diseases related to HIV and antiretroviral drugs.

Ethical Approval :

Ethical authorization for data collection was obtained through an administrative agreement from the Director of the Makokou HIV/AIDS Outpatient Treatment Center (CTA-MKK).

Abreviations

F= Female

M= Male

PLWHIV= people living with HIV

BMI = body mass index

CD4= Cluster of differenciation4

ART= Antiretroviral treatment

PMTCT= Prevention of Mother-to-Child Transmission

HIV= Human immunodeficiency virus

OD= opening of the file

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